

JCM Feasibility Study (FS) 2015
Summary of the Final Report

**“Waste Heat Recovery Power Generation
at Cement Factory in Quang Ninh Province”**

(Implementing Entity: JFE Engineering Corporation)

1. Overview of the proposed JCM Project

Study partners	1. Mitsubishi UFJ Research and Consulting Co., Ltd. (Preliminary Study of Methodology) 2. JFE Engineering India Private Limited (Process Design and etc.)		
Project site	Viet Nam: Hoanh Bo District (near Ha Long Bay), Quang Ninh Province		
Description of project	By introducing Waste Heat Recovery Power Generation System to Thang Long Cement in Quang Ninh Province, the reduction of CO2 and power generation as a substitution of buying grid electric power will be materialized.		
Expected project implementer	Japan	JFE Engineering Corporation	
	Host country	Thang Long Cement Joint Stock Company	
Initial investment	J.Yen 2,450 Mil.	Date of groundbreaking	FY 2017(at the earliest)
Annual maintenance cost	J.Yen 60 Mil.	Construction period	24 Months
Willingness to investment	Yes	Date of project commencement	FY 2019
Financial plan of project	The initial investment cost for the project will be all covered by Thang Long Cement Joint Stock Company with a condition of JCM Subsidy.		
CO2 emission reductions	294,480(tCO2) = 32,720(tCO2/Year) x 9 Years		
GHG emission reductions	Same as above.		

2. Target Project of the Study

(1) Outline of the Project

The proposed project is planned to introduce a waste heat recovery (WHR) boiler steam turbine generator system at an existing cement production plant (Thang Long Cement Joint Stock Company) located near Ha Long Bay in Quang Ninh Province, Viet Nam. The WHR system will utilize waste heat currently emitted from the factory without utilization. WHR boilers will generate steam using the waste heat exhausted from the cement plant, and the steam will be fed to the steam turbine generator to generate electricity at output rate of 8,900kW. Out of 8,900kW, the operation of the WHR system itself consumes power at rated capacity of 1,200kW, and the rest will be used in the operation of the cement plant. The WHR system will contribute to energy saving at the cement plant and to reduction of GHG emission.

(2) Background of the Project

As it is difficult for the local entity alone to implement the WHR project in Viet Nam, Thang Long Cement JSC requests JFE Engineering Corporation to conduct the feasibility study and to lead toward materialization of the WHR project. For the purpose, Thang Long Cement JSC expressed its willingness to cooperate with JFE Engineering Corporation.

Presently, JFE Engineering Corporation is executing WHR project in Consortium with PT Semen Indonesia, who is the parent company of Thang Long Cement JSC, at its Tuban Plant located in East Java under “Facilities Subsidy Scheme 2014 for Project Using the Joint Crediting Mechanism: Facilities Subsidy Project of Power Generation by Waste Heat Recovery in Cement Plant”. The WHR project for Thang Long Cement JSC is in line with the corporate policy of PT Semen Indonesia Group for energy saving and betterment of environment.

Meanwhile, the Government of Viet Nam issued Prime Minister’s Decree No.1488/QD-TTg dated August 29, 2011, in which it was stated that:

“The new cement projects (signing contract of equipment supply from the effective date of this Decision) with kiln capacity of 2,500 tons of clinker/day or more: It is necessary to invest system using waste heat to generate electricity, except for cement production lines using industrial waste and garbage as fuel. For the cement plants in operation, the ongoing cement projects with equipment supply contract signed prior to effective date of this Decision: the investment for this system must be completed before 2015.”

As above, the introduction of the WHR technology to Thang Long Cement JSC is in compliance with the policy of the Government of Viet Nam.

3. Study Plan

(1) Subject and Contents of the Study

Design parameter was studied in light of the expertise of JFE Engineering Corporation and plant process adopted in the recent projects such as WHR projects for PT Semen Padang, which belongs to PT Semen Indonesia, and Tuban Plant of PT Semen Indonesia currently under project execution, and also the recent operating conditions at the factory of Thang Long Cement JSC was taken into consideration. Layout of major equipment such as SP boilers, AQC boiler, Turbine Generator House, Cooling Tower and Electric facility was studied through joint surveys at site.

Construction schedule of the WHR project was studied based on JFE Engineering Corporation's experience of its similar projects in the past and presented to Thang Long Cement JSC for their confirmation.

Planning of operation of the WHR, monitoring and organization at Thang Long Cement JSC was studied on the premises that control system of the WHR would be located within the existing central control room of the cement factory. It is presumed that operators for the WHR will be assigned out of the present team of operators of the central control room.

(2) Organizational Plan of the Study

The study was conducted under the initiative of JFE Engineering Corporation with various data provided by Thang Long Cement JSC. As a part of engineering study, JFE Engineering India Private Limited was employed to plan the related process design. For the purpose of preliminary study of JCM methodology, Mitsubishi UFJ Research and Consulting Co. Ltd., who has professional know-how in the development of JCM methodology, was employed.

(3) Study Schedule

Destination	Discussion Items
1. Field study (Sept.14 - 18, 2015)	
Thang Long Cement JSC (Plant /Head Office)	<ul style="list-style-type: none"> ● Joint site survey at site and studied layout of major equipment(SP Boilers, AQC Boiler, Turbine Generator House, Cooling Tower and Electric facility) ● Basic design conditions of exhaust gas ● Scope of work ● Confirmation of Monitoring system ● Sharing FS schedule and the Project schedule
	<ul style="list-style-type: none"> ● Meeting with Chief Financial Officer ● Hearing about financing plan of WHR project

Ministry of Natural Resource and Environment(MONRE)	<ul style="list-style-type: none"> ●Meeting with the person in charge of Department of Meteorology, Hydrology and Climate Change. Receiving the latest emission factor(2013 version)
2. Field study (Dec.13 - 15, 2015)	
Thang Long Cement JSC (Plant /Head Office)	<ul style="list-style-type: none"> ●Joint site survey at site and studied layout of major equipment(for confirmation) ●Explanation of documents for erection work estimation ●Explanation of heat balance ●Confirmation of actual construction schedule ●Confirmation of project execution formation ●Confirmation of operation formation and maintenance formation ●Confirmation of layout of central control room for WHR.
3. Field study (Feb.16 – 18, 2016)	
Thang Long Cement JSC (Head Office)	<ul style="list-style-type: none"> ●Explanation of the FS report ●Sharing the project schedule

4. Study Results

(1)Feasibility of the Project

1) Implementation Plan of the Project

The WHR project will be implemented, using the Facilities Subsidy Scheme, by International Consortium formed by JFE Engineering Corporation, as the Japanese corporation and as the Representative of the Consortium, and Thang Long Cement JSC, as the Vietnamese corporation and as the Partner of the Consortium.

Thang Long Cement JSC was acquired by PT Semen Indonesia in December of 2012. Share Holders of the company are PT Semen Indonesia holding 70% and local entities holding 30%. The Board of Managements, as of the date of this study, consists of 1 Vietnamese and 5 Indonesians who are all from PT Semen Indonesia. Its revenue in FY2015 is approximately J.Yen 14 billion.

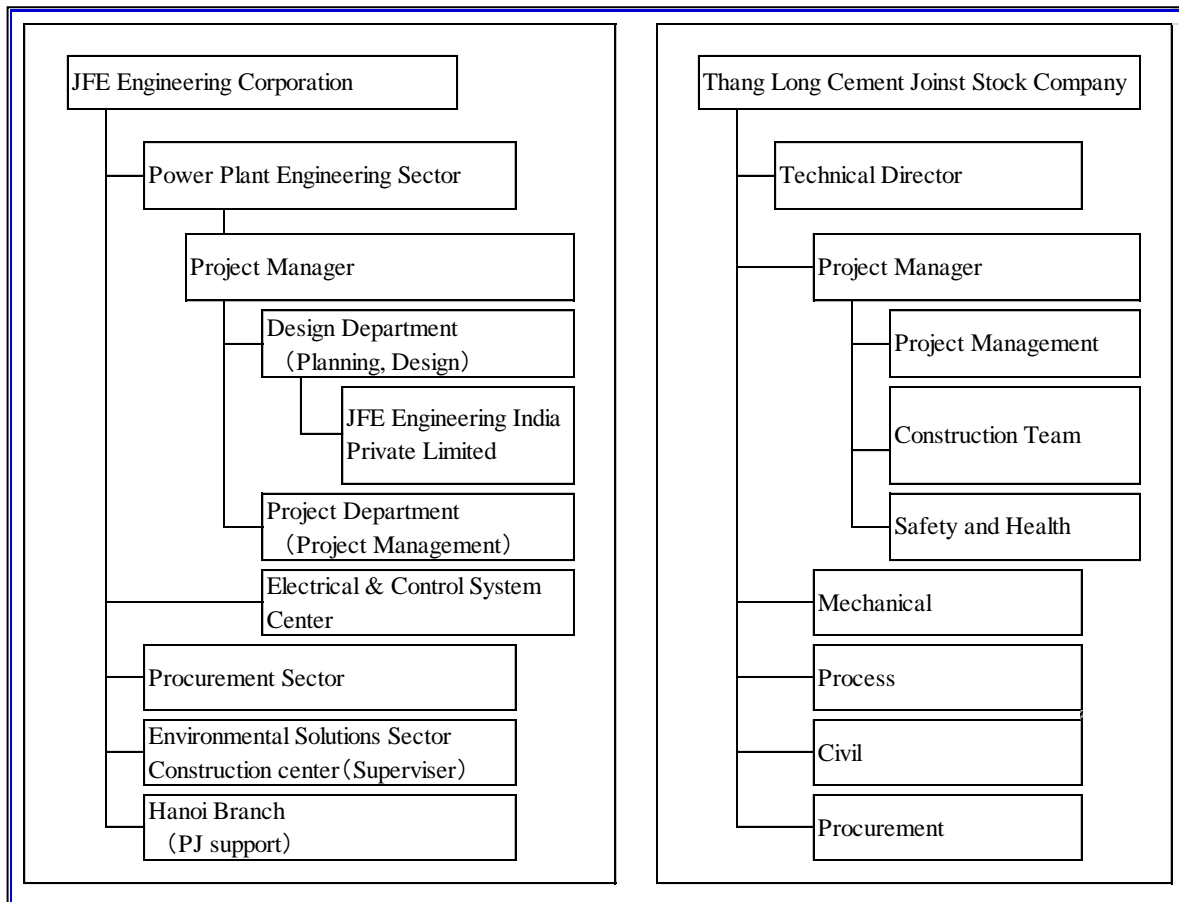


Figure 4.1: Project Execution Formation

2) Financial Plan of the Project

This project is planned on the premise that the JCM Subsidy will be granted. However, a majority of the project fund will be covered by own financial resources of Thang Long Cement JSC, and a budget for the project will be secured through the internal approval process as below:

1. Investment Planning by Line Director and Team
 - ↓
2. Application of Budget by Line Director and Team
 - ↓
3. Assessment by Budget Control Team
 - ↓
4. Budgeting Meeting for the Next Fiscal Year
 - ↓
5. Decision of Budget (Approved by Board of Managements)
 - ↓
6. Application for Approval of Borrowing Loan to PT Semen Indonesia, the Parent Company, or Reporting

Of initial investment of J.Yen 2.45 billion, J.Yen 550 million is presumed to be covered by the Facilities Subsidy of JCM Scheme, and J.Yen 1.9 billion is to be covered by own financial resources of Thang Long Cement JSC by a loan from commercial bank or from PT Semen Indonesia, the parent company. Financing scheme is under review by Thang Long Cement JSC.

(2) Permits and Licenses for the Project

Thang Long Cement JSC studied the subject of Permits and Licenses for the WHR project, and was in the opinion that EIA(Environmental Impact Assessment) is not necessary in light of “Appendix II of Decree No. 18/2015/ND-CP dated 14/2/2015 about Regulation on Planning on environmental Protection, Strategic Environmental Assessment, Environmental Impact Assessment, and Environmental Protection Plan” in which WHR project is not listed as a subject of the permit. Even though permits are not necessary, a reporting to the People’s Committee of Quang Ninh Province and to the People’s Committee of Hoanh Bo District where the project site is located will be necessary before commencement of the construction.

(3) Contribution from Japan

WHR technology for cement industry originated in Japan, and the system was introduced in many cement factories from the late 1970s to the 1980s and is considered a proven technology with high dependability. In Viet Nam, Prime Minister’s Decree issued in August of 2011 mandates that WHR must be implemented at all cement plants with a clinker production capacity of 2,500 ton/day or more. In line with the said decree, implementation of WHR system with the Japanese technology will contribute to reduction of CO2 emission by replacing grid electricity power consumption and reduction of cement production cost by saving approximately 20% of power purchase from the grid, which will result in strengthening corporate tolerance against economic or business fluctuation and against rising industrial electricity cost as an effective means of risk-hedging. Successful implementation of the WHR project will raise the momentum for the dissemination of WHR technology while realizing both environmental conservation and economic development in Viet Nam.

(4) Environmental integrity and Sustainable development in host country

1) Environmental integrity

There is no requirement for the WHR project to conduct EIA as said above and there are no negative impacts on the environment since discharge from the WHR facility is only water.

2) Sustainable Development in host country

WHR system will realize not only a reduction of GHG emission, but also mitigating environmental load to the surroundings and a sustainable benefit of a corporation who will

install the system by reducing cement production cost as a result of reduction of power purchase from the grid.

WHR technology is in line with “Partnership for Quality Infrastructure” “Quality Infrastructure Investment” which the Government of Japan is promoting, and a successful implementation of WHR project at Thang Long Cement JSC, as a model project or show case of Facilities Subsidy Scheme of JCM, will enhance opportunities to realize “Leapfrog” Development for Low-Carbon Society in Viet Nam.

5. JCM methodology Development

(1)Data Collection and Analysis

The methodology ID_AM001 “Power Generation by Waste Heat Recovery in Cement Industry” which was approved under the JCM between Indonesia and Japan is applicable to projects of the same type including this project. In reference to the approved methodology ID_AM001 and the Guidelines for Developing Proposed Methodology adopted in the JCM between Viet Nam and Japan, we listed items to be researched and, based on the list, collected the related data and information which are necessary for developing a methodology. The summary of the result, which is organized in line with the framework of the methodology form, is shown in the below table.

Based on the result of the study on the related data and information, it is considered that the logic in the approved methodology ID_AM001 can be used in principle in a methodology which will be applied to this project.

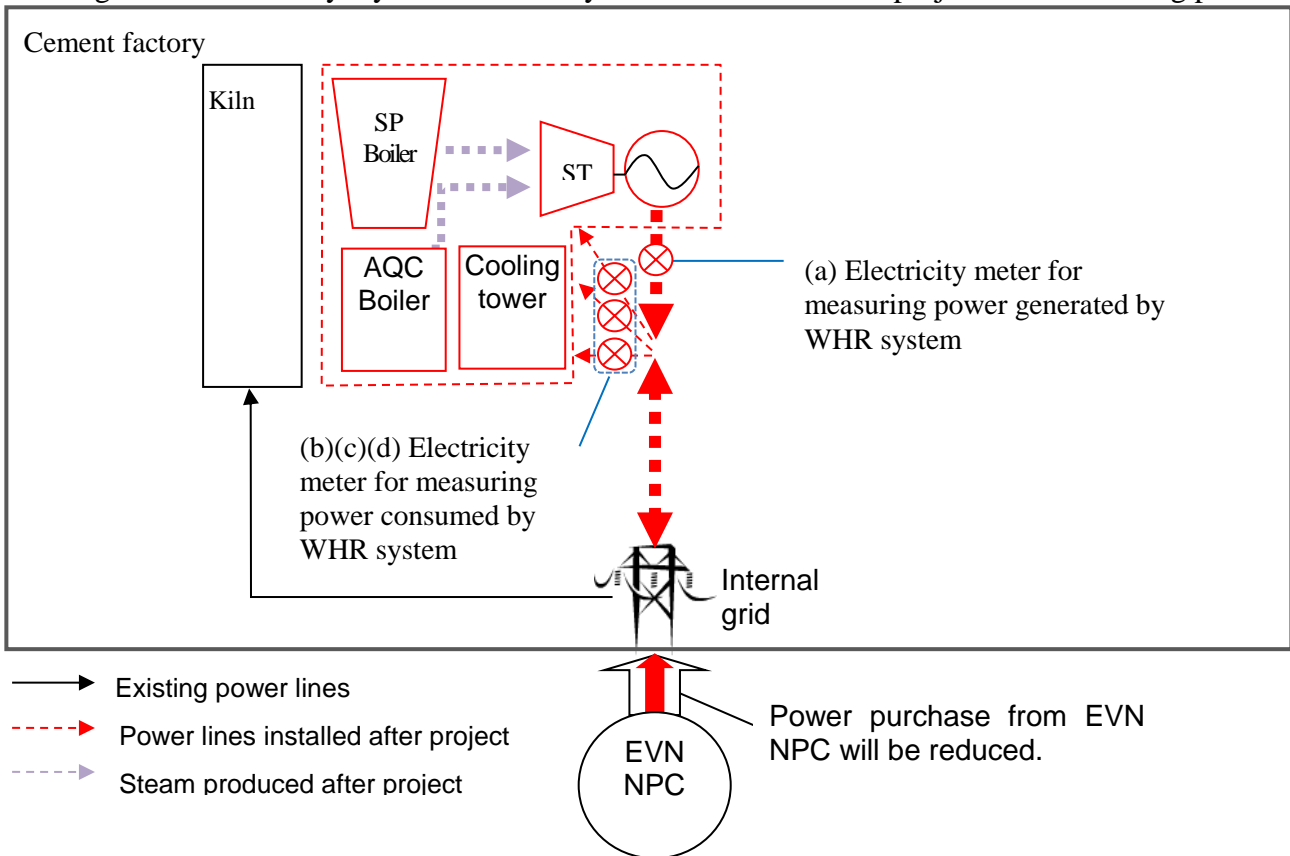
Table 5-1: Summary of data and information which are necessary for methodology development

Item	Necessary data and information	Result of study on data and information
Eligibility criteria	Regulations and/or other plans for Waste Heat Recovery (WHR) system in Viet Nam	Prime minister decision which was published on August 29, 2011 approved the master plan for cement industry development for 2011-2020 and with the orientation for 2030, and the plan shows the development concept for installation of WHR systems.
	Sate of introduction of WHR system to cement factories in Viet Nam	Among 53 cement factories throughout Viet Nam, approximately 3 factories have already installed WHR system, however, the installations in 2 out of 3 factories were financed or expected to be financed through the NEDO model project and CDM project respectively.
	Composition of the WHR system to be introduced by this project	Planned WHR system which will be introduced by the project consists of SP boiler, AQC boiler, turbine generator and cooling tower.
	Use of other fuels or steam in WHR system to be introduced by this project	Planned WHR system will use only waste heat and will not use other fuels or steam.
	Existence of WHR system introduced to the kiln, for which this project will be conducted, before start of the project	There is no WHR system in the cement factory before this project. This project newly introduces the WHR system.
	Source of power used in the cement factory where the project will be conducted	There is a captive power generator in the project cement factory for emergency, however, grid electricity is generally used in the factory except when blackout occurs.
	Intended purpose of use of electricity generated by the WHR system	The project cement factory will use the electricity generated by the WHR system for self consumption.
Calculation of emission reductions	Emission factor of grid electricity	Ministry of Natural Resources and Environment, Viet Nam, publishes the emission factor of the grid electricity.
Monitoring	Standards and/or other regulations for electricity meter in Viet Nam	There are documents which prescribe a procedure and frequency of verification for electricity meter, however, they are not mandatorily applied to those electricity meter other than for commercial trade.

(2)Organizational Plan for MRV

As the electricity generated by the WHR system is assumed to be a monitoring parameter in the methodology to be applied to this project, we plan to install an electricity meter at the point (a) in the below figure. The electricity used by the WHR system is not assumed to be a monitoring parameter but to be calculated based on the rated capacity of the equipment which use electricity, however, we plan to install another electricity meter for measuring the power consumption by the WHR system at the point (b), (c) and (d) in the below figure so as to provide the measured data when required.

Figure 5.1: Summary layout of electricity and steam lines in the project and monitoring point



All of the data measured at the points (a), (b), (c) and (d) is collected by the distributed control system (DCS) and consolidated at the central control room. The amount of electricity which is calculated by subtracting the self-consumption from the generated electricity by the WHR system, which is substitution of electricity due to the WHR system, will be displayed for each hour and input into a ledger sheet as daily report. Monitoring and reporting will be conducted by personnel of the Thang Long Cement JSC as shown in the monitoring structure plan in the below figure. First, an assigned engineer collects, saves and aggregates data and elaborates a report together with background data. After a senior engineer checks the report and all the data with related documents, the manager of electricity and power distribution section checks and approves the report, and elaborates a monthly report. The manager reports it to the deputy production director and the deputy production director approves and archives the monthly report.

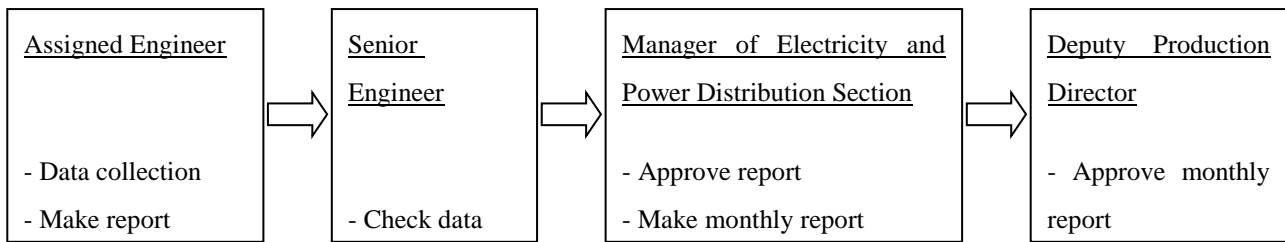


Figure5.2: Monitoring Structure Plan

6. Post Study Plan toward Project Realization

Thang Long Cement JSC is motivated to implement WHR project as they are knowledgeable about economic benefit, CO2 emission reduction and JCM Scheme from two precedent WHR projects of PT Semen Indonesia and also WHR implementation mandated by the Government of Viet Nam. PT Semen Indonesia, the parent company, also supports the WHR project to be realized.

It is the anticipated schedule of the WHR project that the internal approval process within Thang Long Cement JSC, as said above, will take place during the latter half of 2016 and the project will be commenced in FY2017. JFE Engineering Corporation will continue to promote the project in close collaboration with Thang Long Cement JSC, and will further discuss technical subjects as well as commercial conditions that would be necessary for smooth materialization of the project.